CCS Technical Documentation
RH-12/RH-28 Series Transceivers

6(b) - RF Troubleshooting Instructions

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Introduction

This document is the troubleshooting guide for RH-12/RH-28. On the following pages you will find a step-by-step fault finding procedure and reference measurements at the relevant signal points.

Notes on reference measurements

- LF & DC signals are measured with Textronix 100 MHz Scope (TDS3014) and P3010 13pF probe.
- RF signals are measured with R&S FSIQ 7GHz Spectrum Analyzer and Agilent resistive divider probe (10dB, 500ohm).
- Please be aware that the RF connector on service adaptor is leaking power (into air) and acts as noise source when probing on RX chain. In 1800 band the problem is most severe while there is no external LNA to amplify the signal above the noise level like in the 1900 band. In 900/ 850 band the leakage is not as high due to lower frequency.
- GSM SA settings: RBW=500kHz, VBW=500kHz.
- Bluetooth SA settings: RBW=2MHz, VBW=2MHz.
- All reference measurements were made on a RH-12 phone (GSM900). RH-28 (GSM850) results should be very similar.
- RF loss Module Repair Jig: 0.3dB (low bands), 0.4dB (high bands).
- RF loss RF Adaptor: 0.4dB (low band), 0.7dB (high bands).

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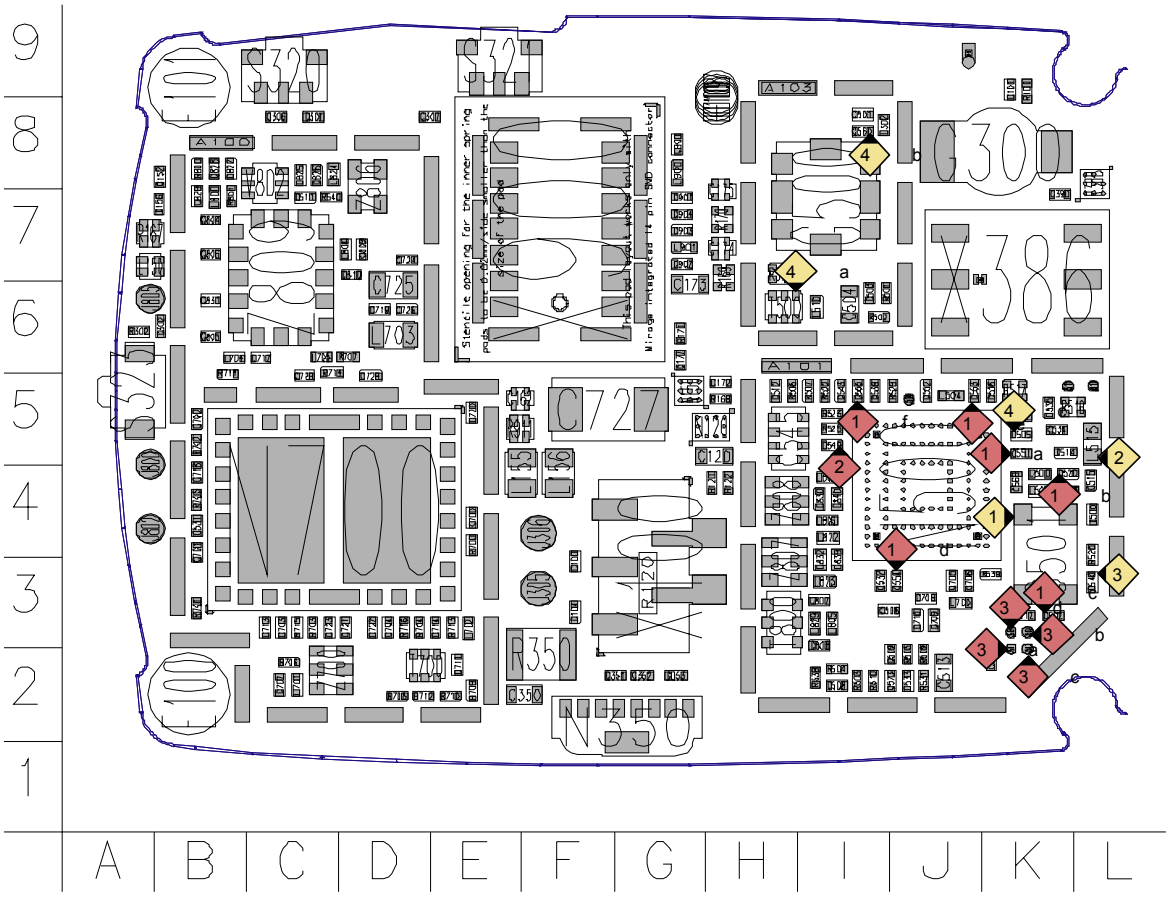
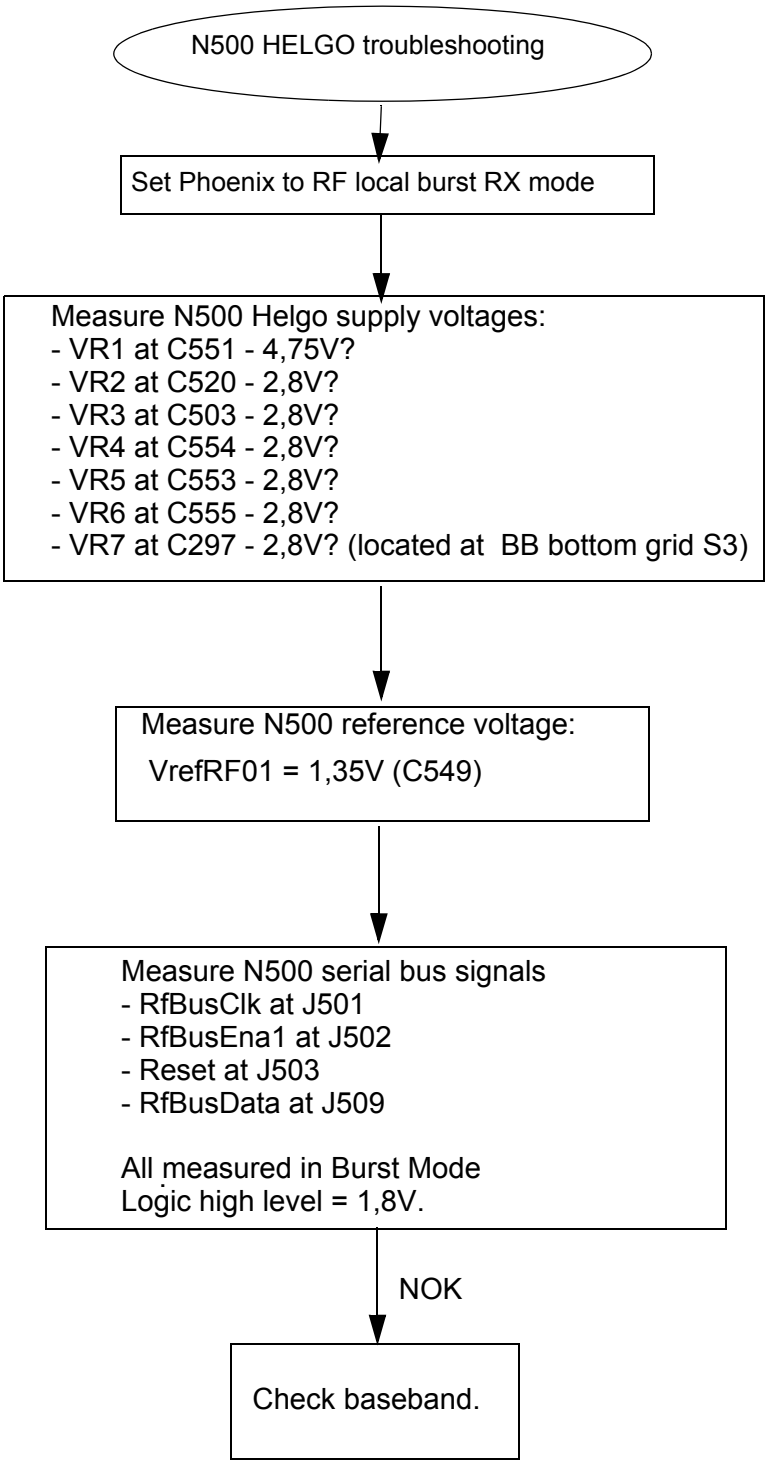
Helgo / Synthesizer Troubleshooting



N500 Helgo troubleshooting


N500 HELGO troubleshooting
Set Phoenix to RF local burst RX mode
Measure N500 Helgo supply voltages:
- VR1 at C551 - 4,75V?
- VR2 at C520 - 2,8V?
- VR3 at C503 - 2,8V?
- VR4 at C554 - 2,8V?
- VR5 at C553 - 2,8V?
- VR6 at C555 - 2,8V?
- VR7 at C297 - 2,8V? (located at BB bottom grid S3)
Measure N500 reference voltage:
VrefRF01 = 1,35V (C549)
Measure N500 serial bus signals
- RfBusClk at J501
- RfBusEna1 at J502
- Reset at J503
- RfBusData at J509
All measured in Burst Mode
Logic high level = 1,8V.
NOK
Check baseband.

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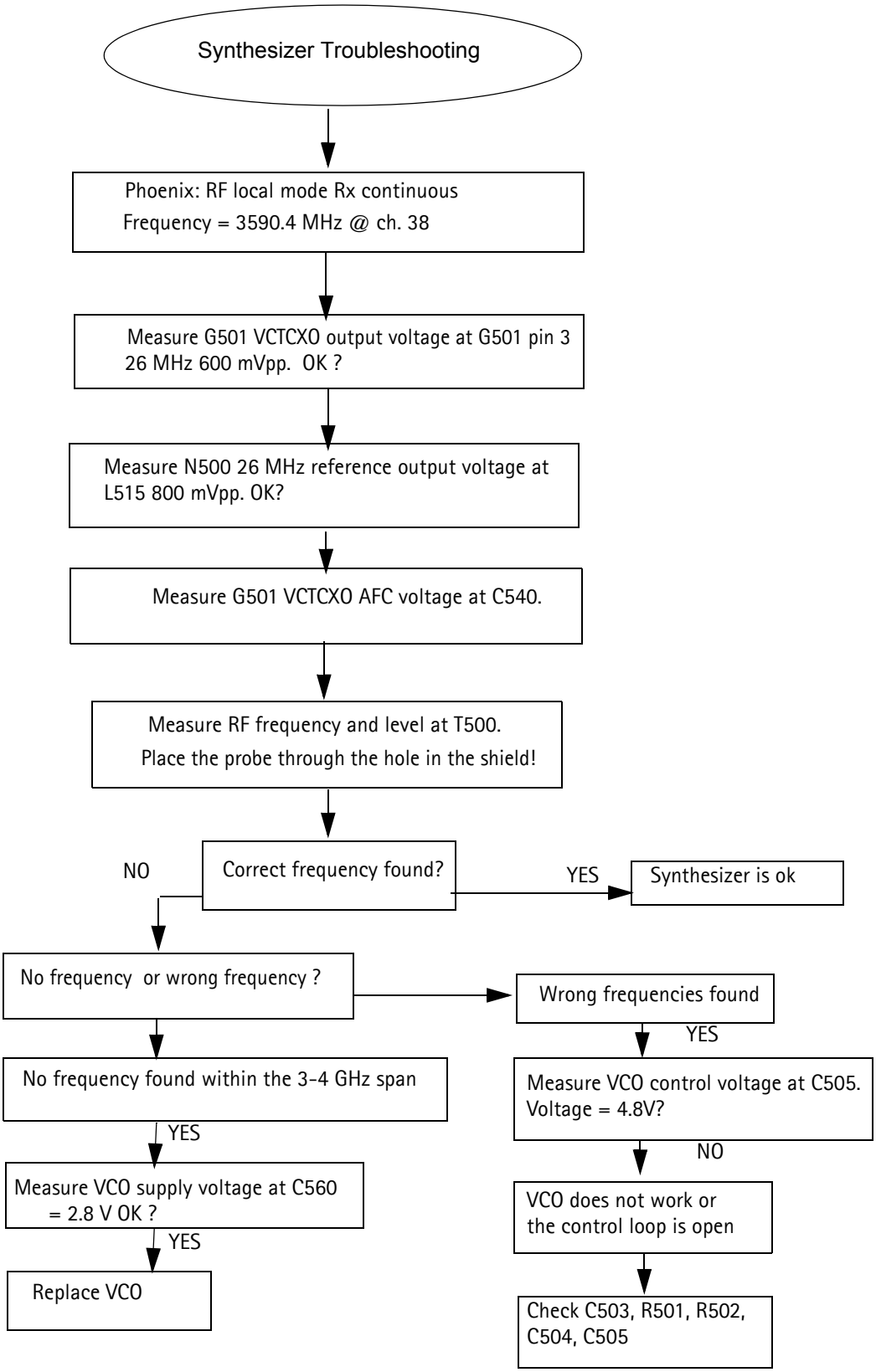
Synthesizer troubleshooting


Synthesizer Troubleshooting
Phoenix: RF local mode Rx continuous
Frequency = 3590.4 MHz @ ch. 38
Measure G501 VCTCXO output voltage at G501 pin 3
26 MHz 600 mVpp. OK ?
Measure N500 26 MHz reference output voltage at
L515 800 mVpp. OK?
Measure G501 VCTCXO AFC voltage at C540.
Measure RF frequency and level at T500.
Place the probe through the hole in the shield!
Correct frequency found?
NO
YES
Synthesizer is ok
No frequency or wrong frequency ?
Wrong frequencies found
YES
No frequency found within the 3-4 GHz span
Measure VCO control voltage at C505.
Voltage = 4.8V?
YES
NO
Measure VCO supply voltage at C560
= 2.8 V OK ?
VCO does not work or
the control loop is open
YES
Replace VCO
Check C503, R501, R502,
C504, C505

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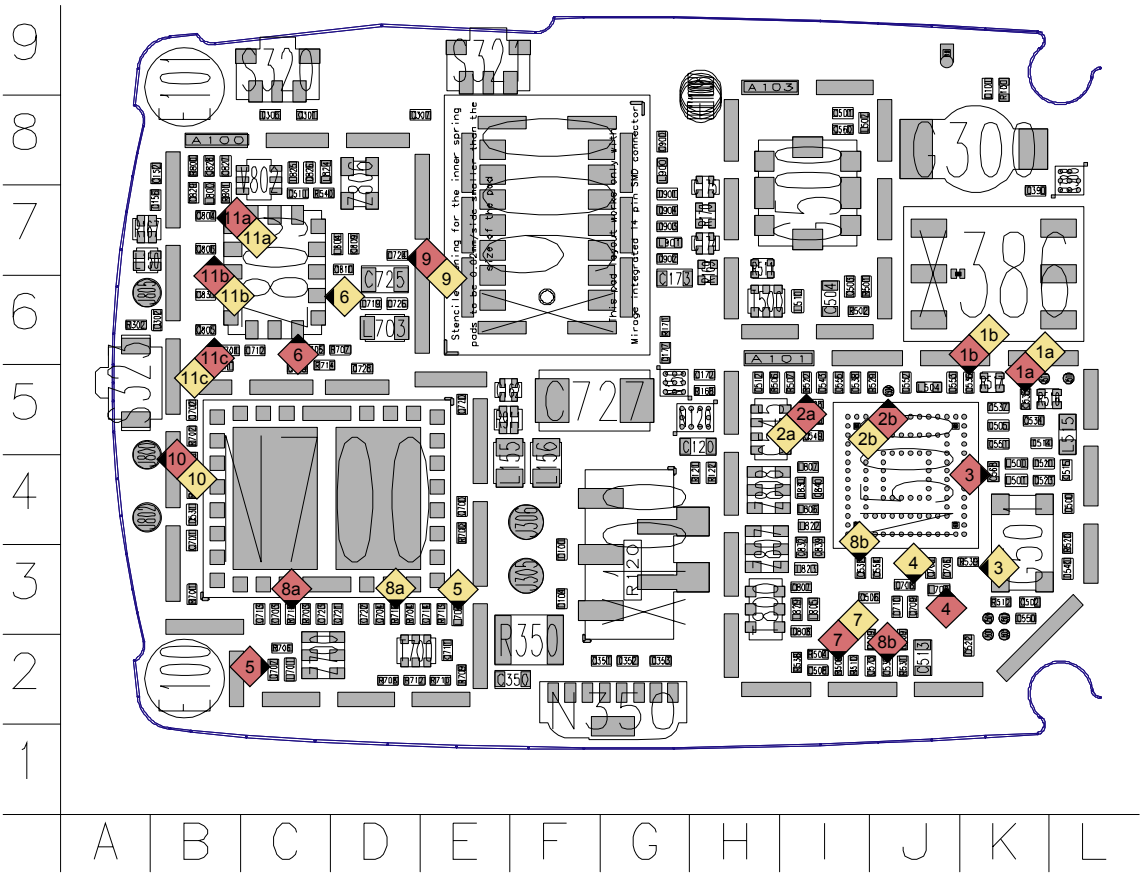
Tx Troubleshooting



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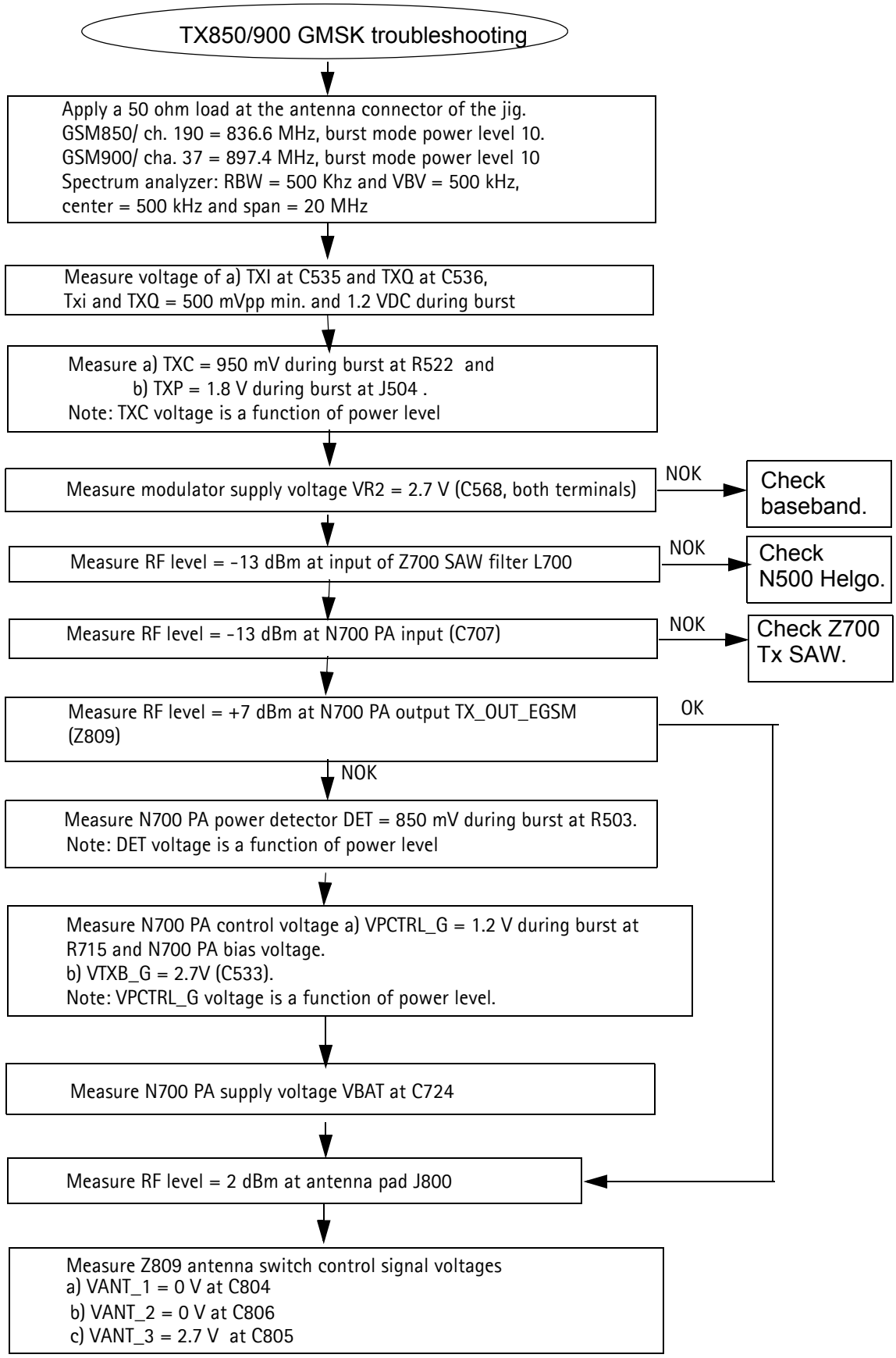
Tx 850/900 GMSK troubleshooting


TX850/900 GMSK troubleshooting
Apply a 50 ohm load at the antenna connector of the jig.
GSM850/ ch. 190 = 836.6 MHz, burst mode power level 10.
GSM900/ cha. 37 = 897.4 MHz, burst mode power level 10
Spectrum analyzer: RBW = 500 Khz and VBV = 500 kHz,
center = 500 kHz and span = 20 MHz
Measure voltage of a) TXI at C535 and TXQ at C536,
Txi and TXQ = 500 mVpp min. and 1.2 VDC during burst
Measure a) TXC = 950 mV during burst at R522 and
b) TXP = 1.8 V during burst at J504 .
Note: TXC voltage is a function of power level
Measure modulator supply voltage VR2 = 2.7 V (C568, both terminals)
NOK
Check baseband.
Measure RF level = -13 dBm at input of Z700 SAW filter L700
NOK
Check N500 Helgo.
Measure RF level = -13 dBm at N700 PA input (C707)
NOK
Check Z700 Tx SAW.
Measure RF level = +7 dBm at N700 PA output TX_OUT_EGSM (Z809)
OK
NOK
Measure N700 PA power detector DET = 850 mV during burst at R503.
Note: DET voltage is a function of power level
Measure N700 PA control voltage a) VPCTRL_G = 1.2 V during burst at R715 and N700 PA bias voltage.
b) VTXB_G = 2.7V (C533).
Note: VPCTRL_G voltage is a function of power level.
Measure N700 PA supply voltage VBAT at C724
Measure RF level = 2 dBm at antenna pad J800
Measure Z809 antenna switch control signal voltages
a) VANT_1 = 0 V at C804
b) VANT_2 = 0 V at C806
c) VANT_3 = 2.7 V at C805

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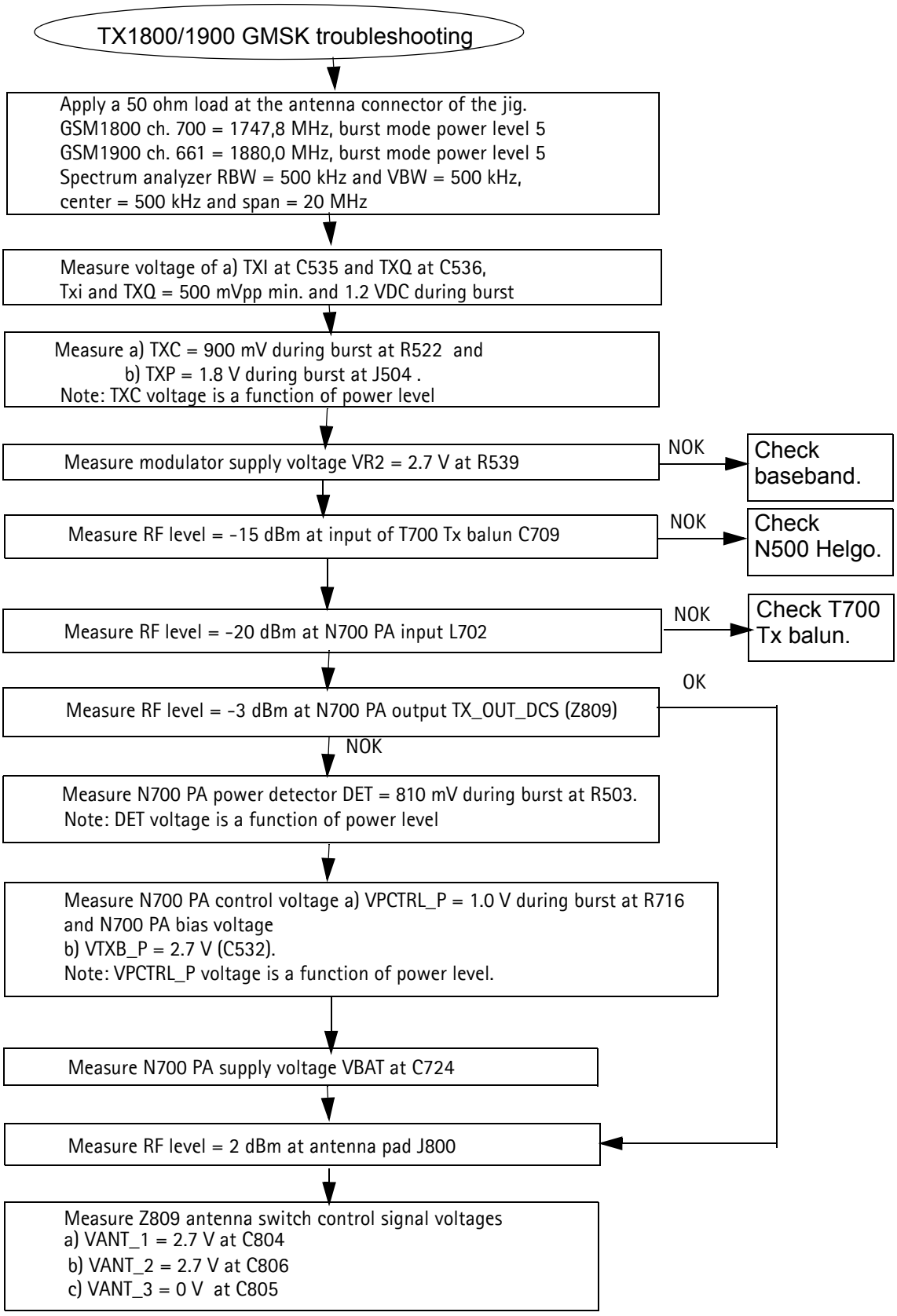
Tx 1800/1900 GMSK troubleshooting


TX1800/1900 GMSK troubleshooting
Apply a 50 ohm load at the antenna connector of the jig.
GSM1800 ch. 700 = 1747,8 MHz, burst mode power level 5
GSM1900 ch. 661 = 1880,0 MHz, burst mode power level 5
Spectrum analyzer RBW = 500 kHz and VBW = 500 kHz,
center = 500 kHz and span = 20 MHz
Measure voltage of a) TXI at C535 and TXQ at C536,
Txi and TXQ = 500 mVpp min. and 1.2 VDC during burst
Measure a) TXC = 900 mV during burst at R522 and
b) TXP = 1.8 V during burst at J504 .
Note: TXC voltage is a function of power level
Measure modulator supply voltage VR2 = 2.7 V at R539
NOK
Check baseband.
Measure RF level = -15 dBm at input of T700 Tx balun C709
NOK
Check N500 Helgo.
Measure RF level = -20 dBm at N700 PA input L702
NOK
Check T700 Tx balun.
OK
Measure RF level = -3 dBm at N700 PA output TX_OUT_DCS (Z809)
NOK
Measure N700 PA power detector DET = 810 mV during burst at R503.
Note: DET voltage is a function of power level
Measure N700 PA control voltage a) VPCTRL_P = 1.0 V during burst at R716
and N700 PA bias voltage
b) VTXB_P = 2.7 V (C532).
Note: VPCTRL_P voltage is a function of power level.
Measure N700 PA supply voltage VBAT at C724
Measure RF level = 2 dBm at antenna pad J800
Measure Z809 antenna switch control signal voltages
a) VANT_1 = 2.7 V at C804
b) VANT_2 = 2.7 V at C806
c) VANT_3 = 0 V at C805

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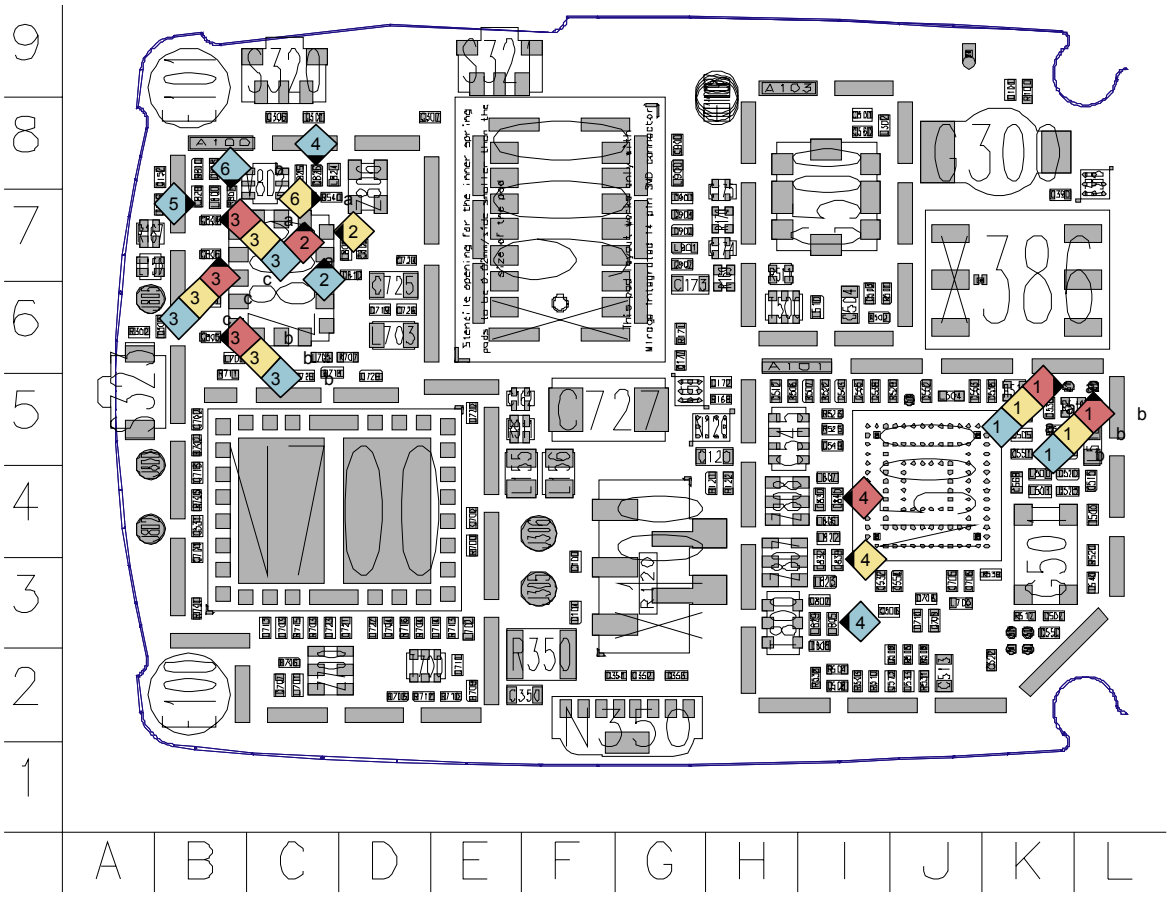
Rx Troubleshooting



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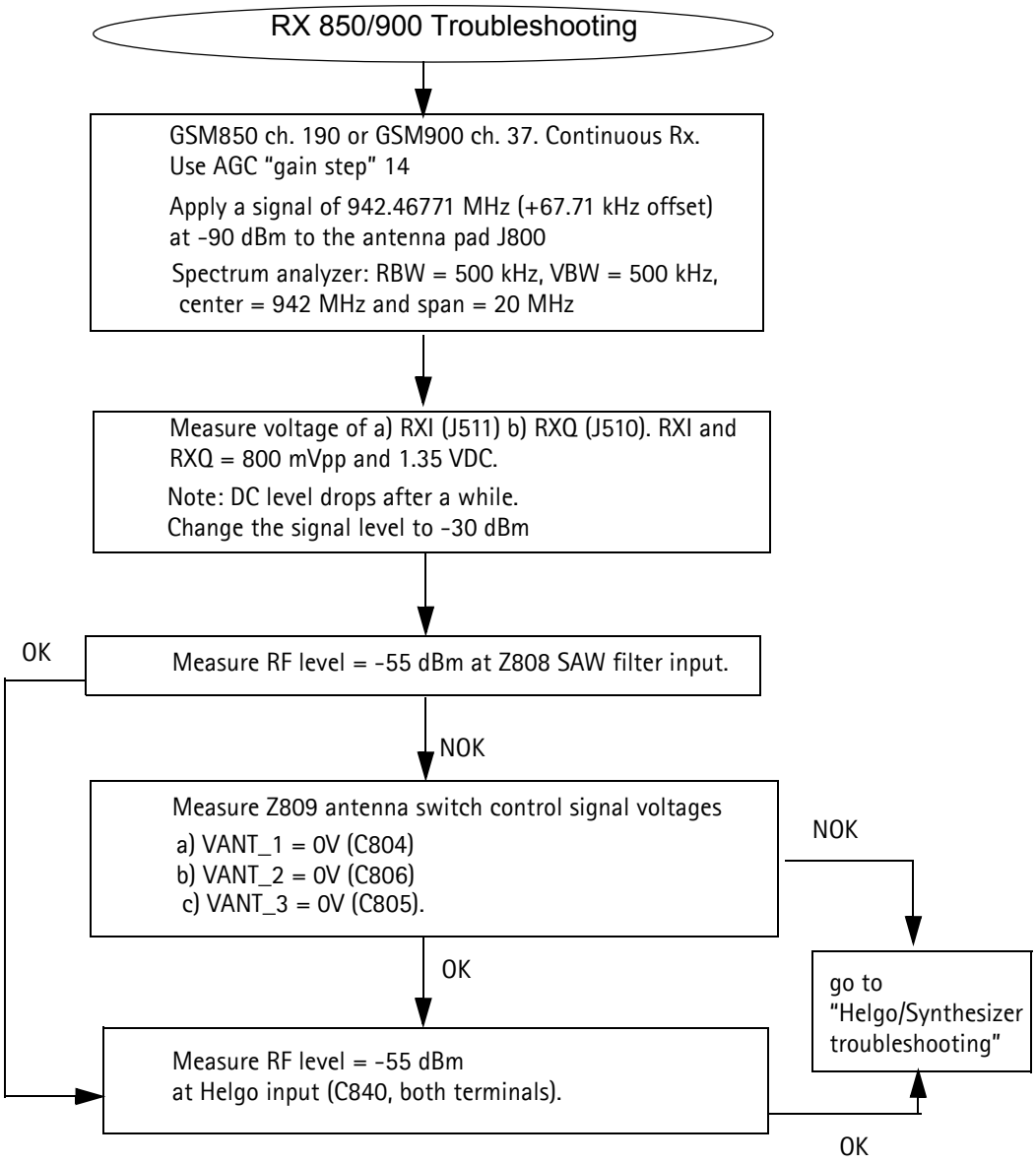
Rx 850/900 troubleshooting


RX 850/900 Troubleshooting
GSM850 ch. 190 or GSM900 ch. 37. Continuous Rx.
Use AGC "gain step" 14
Apply a signal of 942.46771 MHz (+67.71 kHz offset)
at -90 dBm to the antenna pad J800
Spectrum analyzer: RBW = 500 kHz, VBW = 500 kHz,
center = 942 MHz and span = 20 MHz
Measure voltage of a) RXI (J511) b) RXQ (J510). RXI and
RXQ = 800 mVpp and 1.35 VDC.
Note: DC level drops after a while.
Change the signal level to -30 dBm
OK
Measure RF level = -55 dBm at Z808 SAW filter input.
NOK
Measure Z809 antenna switch control signal voltages
a) VANT_1 = 0V (C804)
b) VANT_2 = 0V (C806)
c) VANT_3 = 0V (C805).
NOK
go to
"Helgo/Synthesizer
troubleshooting"
OK
Measure RF level = -55 dBm
at Helgo input (C840, both terminals).
OK

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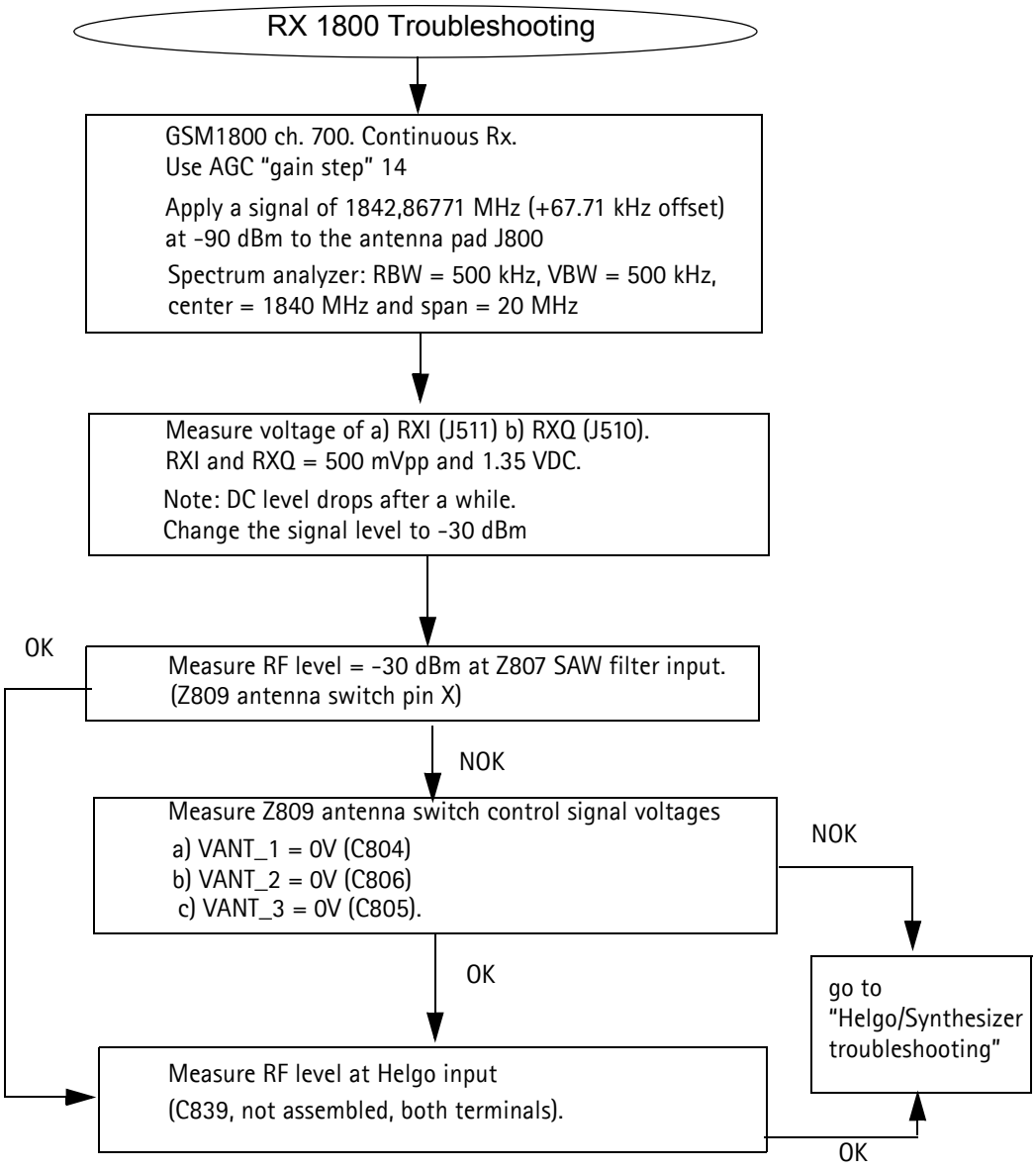
Rx 1800 troubleshooting


RX 1800 Troubleshooting
GSM1800 ch. 700. Continuous Rx.
Use AGC "gain step" 14
Apply a signal of 1842,86771 MHz (+67.71 kHz offset)
at -90 dBm to the antenna pad J800
Spectrum analyzer: RBW = 500 kHz, VBW = 500 kHz,
center = 1840 MHz and span = 20 MHz
Measure voltage of a) RXI (J511) b) RXQ (J510).
RXI and RXQ = 500 mVpp and 1.35 VDC.
Note: DC level drops after a while.
Change the signal level to -30 dBm
OK
Measure RF level = -30 dBm at Z807 SAW filter input.
(Z809 antenna switch pin X)
NOK
Measure Z809 antenna switch control signal voltages
a) VANT_1 = 0V (C804)
b) VANT_2 = 0V (C806)
c) VANT_3 = 0V (C805).
NOK
OK
go to
"Helgo/Synthesizer
troubleshooting"
Measure RF level at Helgo input
(C839, not assembled, both terminals).
OK

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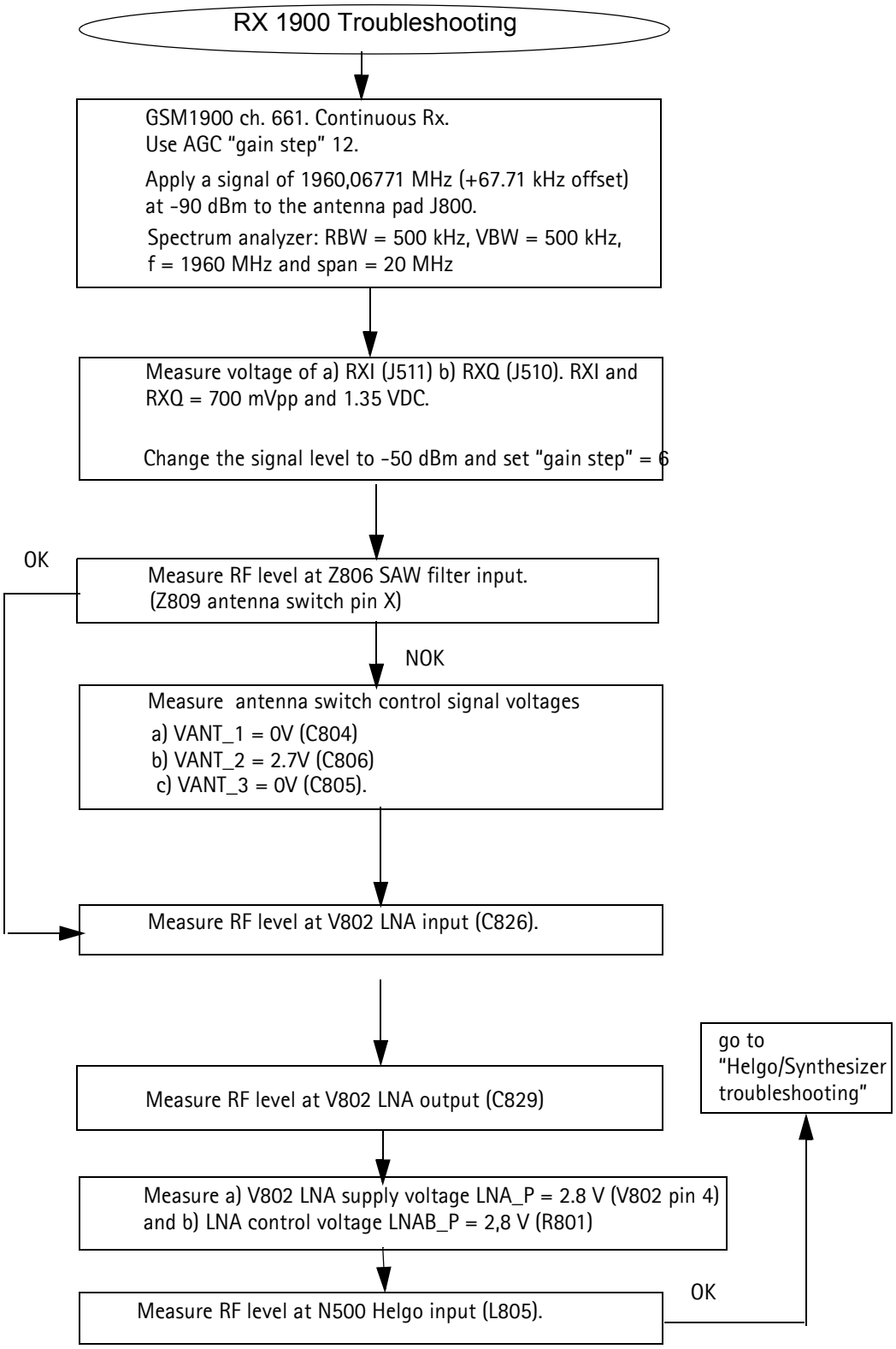
Rx 1900 troubleshooting


RX 1900 Troubleshooting
GSM1900 ch. 661. Continuous Rx.
Use AGC "gain step" 12.
Apply a signal of 1960,06771 MHz (+67.71 kHz offset) at -90 dBm to the antenna pad J800.
Spectrum analyzer: RBW = 500 kHz, VBW = 500 kHz, f = 1960 MHz and span = 20 MHz
Measure voltage of a) RXI (J511) b) RXQ (J510). RXI and RXQ = 700 mVpp and 1.35 VDC.
Change the signal level to -50 dBm and set "gain step" = 6
OK
Measure RF level at Z806 SAW filter input. (Z809 antenna switch pin X)
NOK
Measure antenna switch control signal voltages
a) VANT_1 = 0V (C804)
b) VANT_2 = 2.7V (C806)
c) VANT_3 = 0V (C805).
Measure RF level at V802 LNA input (C826).
Measure RF level at V802 LNA output (C829)
Measure a) V802 LNA supply voltage LNA_P = 2.8 V (V802 pin 4) and b) LNA control voltage LNAB_P = 2,8 V (R801)
Measure RF level at N500 Helgo input (L805).
OK
go to "Helgo/Synthesizer troubleshooting"

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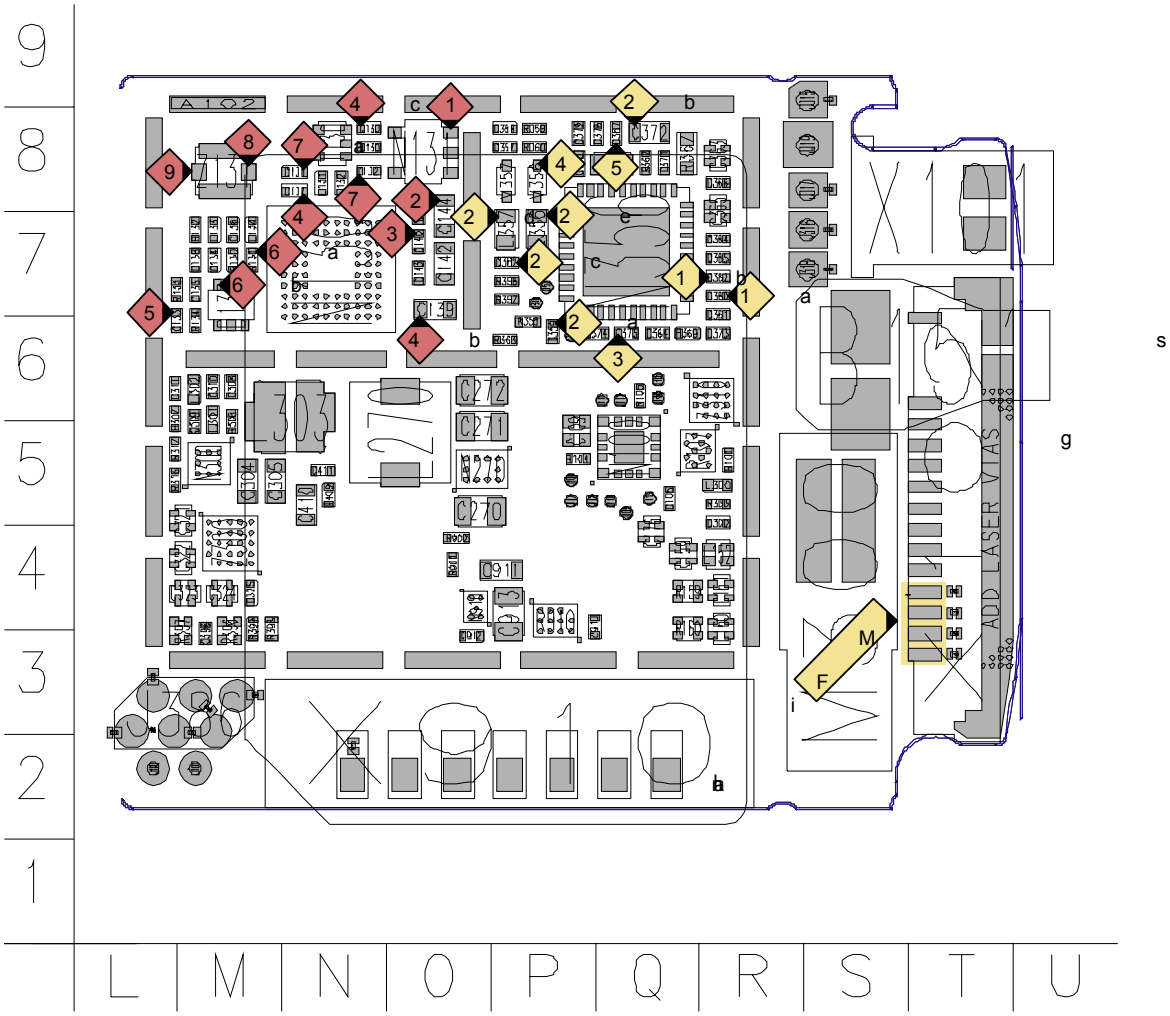
Bluetooth / FM Radio Troubleshooting



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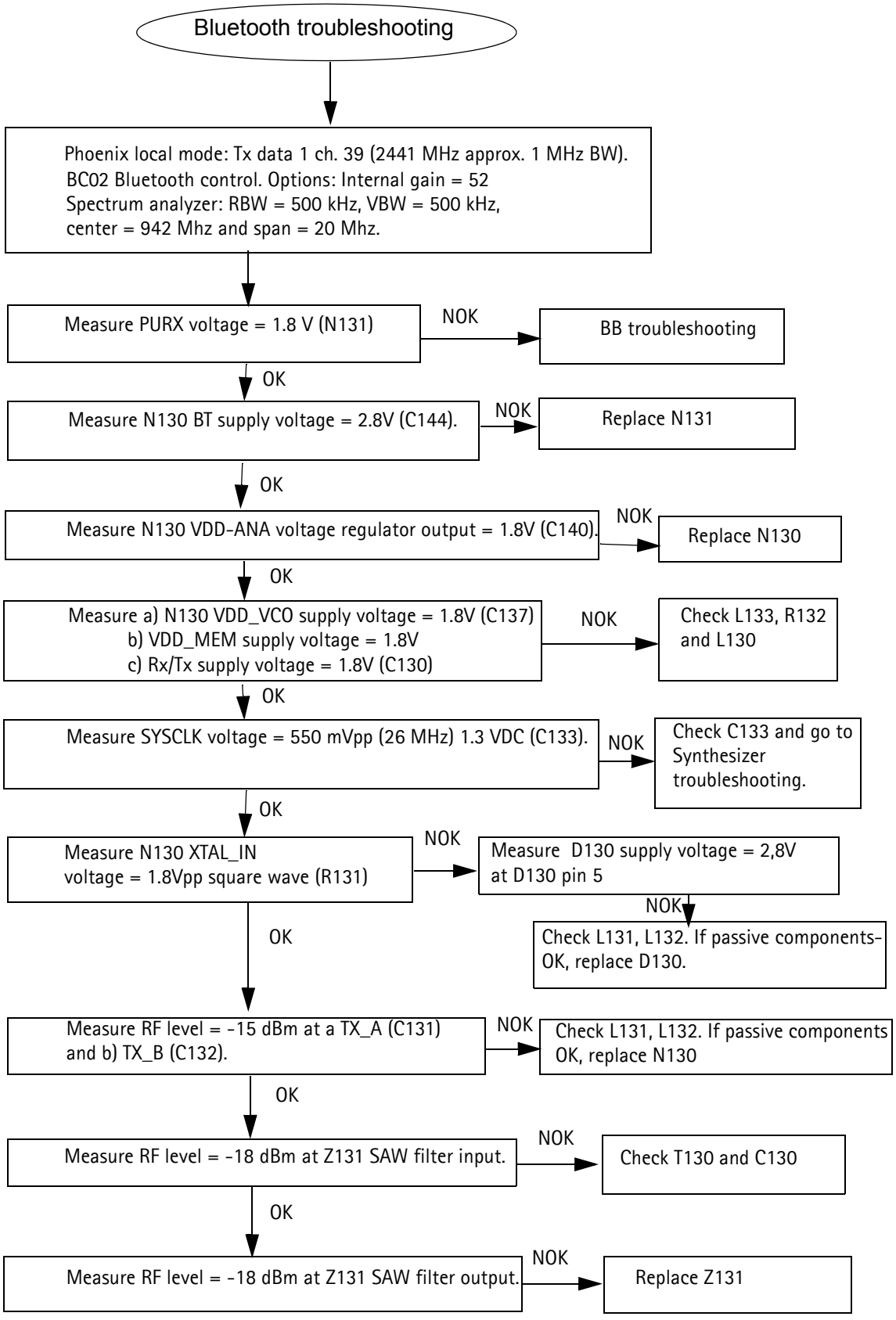
Bluetooth troubleshooting


Bluetooth troubleshooting
Phoenix local mode: Tx data 1 ch. 39 (2441 MHz approx. 1 MHz BW).
BC02 Bluetooth control. Options: Internal gain = 52
Spectrum analyzer: RBW = 500 kHz, VBW = 500 kHz,
center = 942 Mhz and span = 20 Mhz.
Measure PURX voltage = 1.8 V (N131)
NOK
BB troubleshooting
OK
Measure N130 BT supply voltage = 2.8V (C144).
NOK
Replace N131
OK
Measure N130 VDD-ANA voltage regulator output = 1.8V (C140).
NOK
Replace N130
OK
Measure a) N130 VDD_VCO supply voltage = 1.8V (C137)
b) VDD_MEM supply voltage = 1.8V
c) Rx/Tx supply voltage = 1.8V (C130)
NOK
Check L133, R132
and L130
OK
Measure SYSCLK voltage = 550 mVpp (26 MHz) 1.3 VDC (C133).
NOK
Check C133 and go to
Synthesizer
troubleshooting.
OK
Measure N130 XTAL_IN
voltage = 1.8Vpp square wave (R131)
NOK
Measure D130 supply voltage = 2,8V
at D130 pin 5
NOK
Check L131, L132. If passive components-
OK, replace D130.
OK
Measure RF level = -15 dBm at a TX_A (C131)
and b) TX_B (C132).
NOK
Check L131, L132. If passive components
OK, replace N130
OK
Measure RF level = -18 dBm at Z131 SAW filter input.
NOK
Check T130 and C130
OK
Measure RF level = -18 dBm at Z131 SAW filter output.
NOK
Replace Z131

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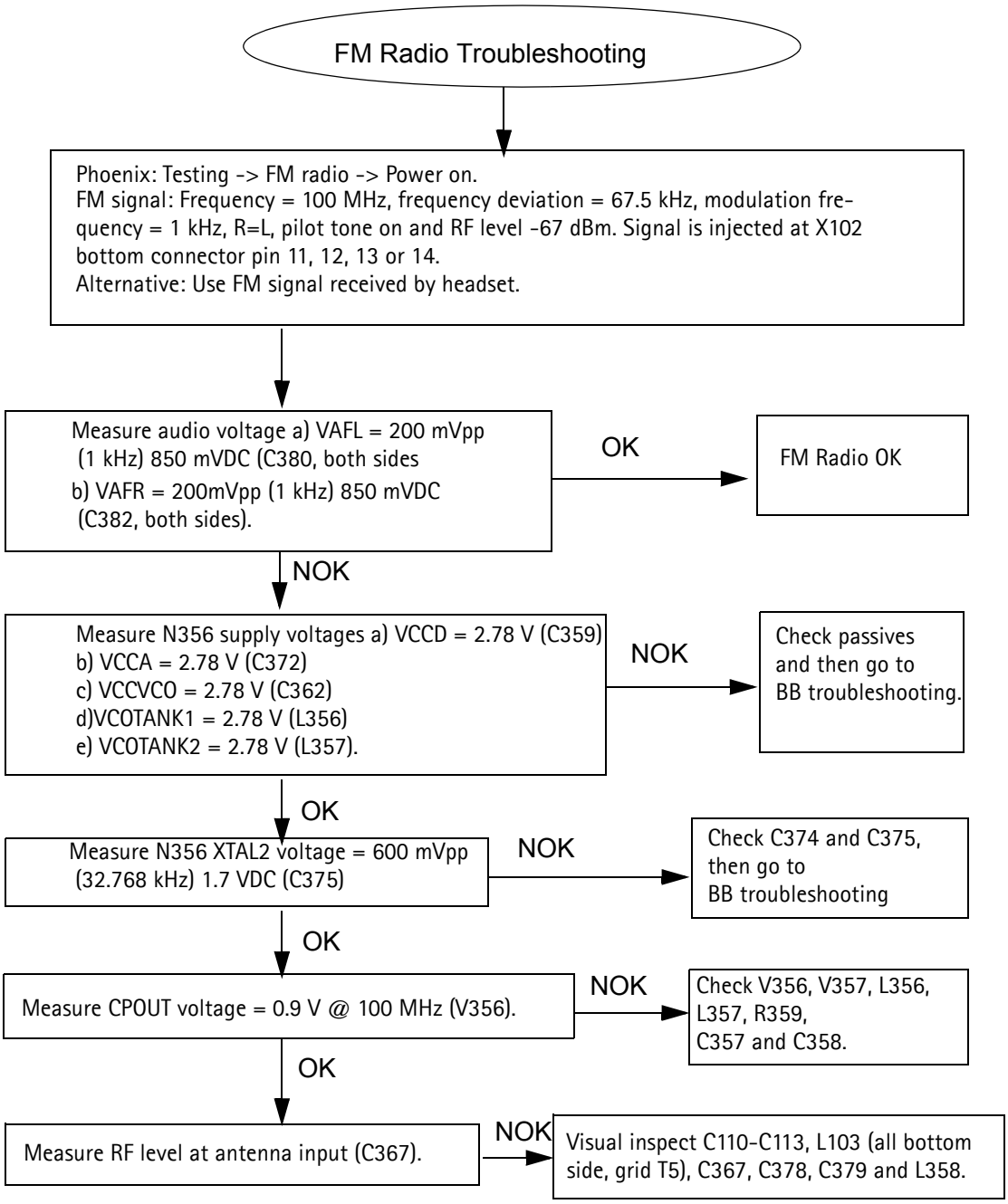
FM radio troubleshooting


FM Radio Troubleshooting
Phoenix: Testing -> FM radio -> Power on.
FM signal: Frequency = 100 MHz, frequency deviation = 67.5 kHz, modulation frequency = 1 kHz, R=L, pilot tone on and RF level -67 dBm. Signal is injected at X102 bottom connector pin 11, 12, 13 or 14.
Alternative: Use FM signal received by headset.
Measure audio voltage a) VAFL = 200 mVpp (1 kHz) 850 mVDC (C380, both sides
b) VAFR = 200mVpp (1 kHz) 850 mVDC (C382, both sides).
OK
FM Radio OK
NOK
Measure N356 supply voltages a) VCCD = 2.78 V (C359)
b) VCCA = 2.78 V (C372)
c) VCCVCO = 2.78 V (C362)
d)VCOTANK1 = 2.78 V (L356)
e) VCOTANK2 = 2.78 V (L357).
NOK
Check passives and then go to BB troubleshooting.
OK
Measure N356 XTAL2 voltage = 600 mVpp (32.768 kHz) 1.7 VDC (C375)
NOK
Check C374 and C375, then go to BB troubleshooting
OK
Measure CPOUT voltage = 0.9 V @ 100 MHz (V356).
NOK
Check V356, V357, L356, L357, R359, C357 and C358.
OK
Measure RF level at antenna input (C367).
NOK
Visual inspect C110-C113, L103 (all bottom side, grid T5), C367, C378, C379 and L358.

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